OpenLabyrinth User Guide

for OpenLabyrinth version 2.5

November 2009

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1: Introduction

1.1: What's new in version 2.5

The last major release of OpenLabyrinth was v2.08 released in early 2009. This new version, v2.5, includes a great many new and upgraded features as well as a large refactoring of the codebase.

The following are the main changes in version 2.5:

- Visual labyrinth editor
- Vue export and resync
- Upgraded MedBiquitous Virtual Patient import and export
- Counters on links
- Search
- Embedded questions
- Nodegrid and countergrid editors
- Collections
- Counter visibility
- Improved data element and cluster handling
- Improved file management
- User interface improvements

1.2: What is OpenLabyrinth?

OpenLabyrinth is an open source online activity modelling system that allows users to build interactive 'game-informed' educational activities such as virtual patients, simulations, games, mazes and algorithms. It has been designed to be adaptable and simple to use while retaining a wealth of game-like features. OpenLabyrinth is licensed under the Academic Free License (AFL) v. 3.0 – see appendix 2.

The original Labyrinth application was originally developed by the Learning Technology Section of the College of Medicine and Veterinary Medicine at the University of Edinburgh. This latest version includes work from the Northern Ontario School of Medicine and the University of Edinburgh as well as input from partners in Canada, the UK, Germany, Australia and the US. This guide is intended to act both as user guide and technical documentation for the system.

1.3: Installing OpenLabyrinth

OpenLabyrinth is a web application written using Active Server Page (ASP) code written in VBScript. To run it needs to be running in Internet Information Services (IIS) which is part of Microsoft server technologies (as well as Windows XP/Vista for single users). OpenLabyrinth also requires a database joining the code and the database using an ODBC connector. The most suitable database is MS SQL Server (the Express edition is available for free). See appendix 1 for more details on how to install and configure OpenLabyrinth.

1.4: Labyrinths

A 'labyrinth' is the principal unit of organisation within OpenLabyrinth. Each labyrinth has a series of global properties such as the type (game, maze, algorithm etc), its authors, timers, visual appearance (skins), security,

scores and counters etc. Within each labyrinth there are a series of linked pages or ‘nodes’ that define the options available to the user, each of which can be enhanced with a number of behaviours and services to further structure the user’s experience and gameplay.

1.5: Nodes

A labyrinth’s nodes are the unit of presentation to the user, typically webpages, around which all the other labyrinth components are organised. Although a labyrinth can have just the one node, typically they will consist of many interconnected nodes. Figure 1 shows a diagrammatic representation of a simple activity consisting of six nodes.

Every labyrinth node has a unique identifier (node ID) as well as a number of other properties such as a title, textual content, a type (root or child) and a series of rule and function properties. The rules and functions determine what is presented to the user at any given node depending both on current node properties and what the user has done previously (particularly concerning scores and counters). Other node properties include whether it is the root node (the labyrinth starting point), whether the node must be visited or avoided and whether the user can end the session and see a report of how they did.

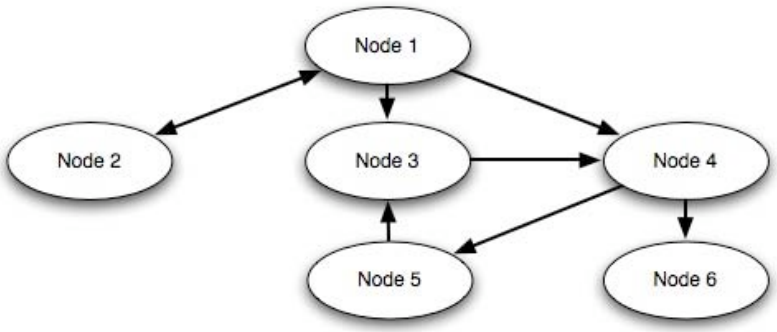


Figure 1: nodes and links: node 1 is linked to nodes 2, 3 and 4, node 2 is linked back to node 1, node 3 is linked to node 4, node 4 is linked to nodes 5 and 6, node 5 is linked to node 3 and node 6 isn’t linked to anything.

1.6: Links

Labyrinth nodes are connected by a series of links expressed as pairs of node IDs with some additional properties such as ordering, icons and alternative text. Because links are one directional (from node A to node B) a link back requires a second link (from node B to node A) with independent properties. There are 8 links indicated in figure 1 because there is a link from node 1 to 2 and another separate one from node 2 to 1.

Links can be presented to the user in four different ways

- Hypertext – clickable text link per available choice
- Drop down – a dropdown list of the available choices
- Dropdown with confidence interval – as above with a second drop down indicating how confident (or unconfident) the user was about their choice
- Type in text – the user types in the first few letters of their proposed answer and if it matches an available option this is auto filled for the user.

The order of these available options can be set, randomized or randomly set to present just the one option.

1.7: Rules

Rules are functions attached to nodes that change the way a labyrinth is presented to the user. One set of rules might set or change one or more counters while another could require a user to have visited other nodes before being able to load the current one. In a little more detail these rules include:

- Counters: there can be as many or as few counters in a Labyrinth as you want. Each counter has a name, description, starting value and a number of functions. At the entry to any node or on clicking any link the value for each and every counter can be changed using plus, minus or equals operators along with an integer value; '+10' adds ten, '=4' sets the value to 4 irrespective of its previous value. These values can then trigger rules based on the current value of each counter.
- Conditionals: these control access to a node based on which nodes the user has visited previously. For instance a rule that looks like "{15}OR{16}" would mean that a user couldn't enter node 17 without having visited nodes 15 or 16 first. Each rule is made up of node IDs connected with standard Boolean operators.
- Timers: these provide a real time countdown at the end of which the user needs to restart the activity. A 300 second timer would mean that the user would need to complete the activity in 5 minutes.

1.8: Feedback

The user can be given extensive feedback based on their choices in playing a labyrinth. This includes a report of which choices were made, the counter values and whether nodes were marked as 'must visit' or 'must avoid'.

There are a number of author-configured feedback rules including:

- Feedback per node visited
- Feedback depending on the numbers of 'must visit' and 'must avoid' nodes visited
- Feedback on the time taken to complete
- Feedback on values of counters at the end of the session

1.9: Data Elements and Clusters

OpenLabyrinth has been designed to import to and export from the MedBiquitous virtual patient data standard, an emerging specification for the exchange and reuse of virtual patient activities between different authoring and player systems. The MVP model is made up of four components:

- VPD: virtual patient data – functioning as the electronic patient record, a VPD is a collection of VPD elements. Although designed to support clinical data this could just as easily be used to support any reusable data element such as a character name or unit of measure. These are therefore called 'data elements' in OpenLabyrinth.
- MR: media resources – this includes all supporting files including images and documents. An MR Set is a collection of MR elements. Each MR element has properties of name, path, mime type and arguments. Media resources are handled using the OpenLabyrinth file manager.
- AM: activity model – this describes what the user can (and cannot) do. Activities are described as a series of nodes containing narrative and educational content with links between them. Both nodes and links have rules associated with them to enhance the options for educational gameplay. This maps directly to the node and link aspects of OpenLabyrinth.
- DAM: data availability model – aggregations of VPD and MR elements. DAM contains at least one VPD element or MR element, although more typically it contains many such elements.

In terms of OpenLabyrinth, its activities correspond to the OpenLabyrinth activity itself, MR equates to the file handling capacity of OpenLabyrinth while VPD and DAM functionality have been added as 'data elements' and 'data clusters' respectively. VPD and MR data elements can be linked directly into an activity node or via a DAM aggregate of VPD and MR elements (see figure 2).

OpenLabyrinth can both export MedBiquitous Virtual Patient packages (a zip file with XML and other files inside) from a labyrinth and it can import MedBiquitous Virtual Patient packages to create new labyrinths.

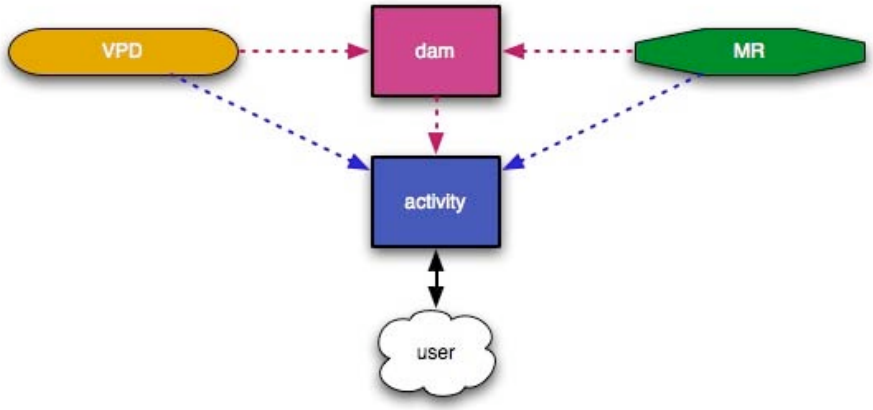


Figure 2: The relationship between VPS, MR, DAM and activity elements in OpenLabyrinth. The user only works with the activity; all elements are therefore surfaced within the activity.

1.10: Avatars

One way of enhancing a narrative is to identify human characters or agents within its flow. OpenLabyrinth supports the use of characters by providing support for simple animated avatars for these characters in the narrative. An avatar can be configured to appear differently (age, skin, hair, clothing, context) as well as communicate using speech or thought bubbles. The same avatar can be reused with different settings throughout a Labyrinth. Or a number of different characters can be used.

1.11: Questions

Ad hoc text-based questions can be added to collect learner thoughts and feedback during a labyrinth activity.

1.12: OpenLabyrinth Remote Services

In addition to users running a labyrinth within OpenLabyrinth itself, there is a web-service that allows activities to be run remotely. To run a remote OpenLabyrinth service you need to have a remote service (including a single client IP address) registered within OpenLabyrinth, one or more OpenLabyrinth maps associated with that service, and a means of presenting the activity to the user in the remote environment. This OpenLabyrinth ‘client’ application would need to be able to consume the XML generated by the service and render it so that the user was given the links and services required to run the labyrinth remotely and interact with the OpenLabyrinth server.

1.13: Presentations

A presentation is an arbitrary set of labyrinths grouped together for users to access together. This may be a set of materials for a particular course, an examination paper or a group topic.

2: Running a Labyrinth

This section describes the steps a user takes to start and work through a labyrinth– note that this will be different for users of remote OpenLabyrinth services, which will depend on the way the OpenLabyrinth client is instantiated and run as to how the interaction works.

2.1: Permissions

The only labyrinths a user can run without logging in are those whose security has been set to 'open'. Labyrinths with a security setting of 'closed' can be viewed by anyone logged into OpenLabyrinth while 'private' maps can only be viewed by their logged in editors. To start a labyrinth just click on its title. This loads the first node and displays it (see figure 3).

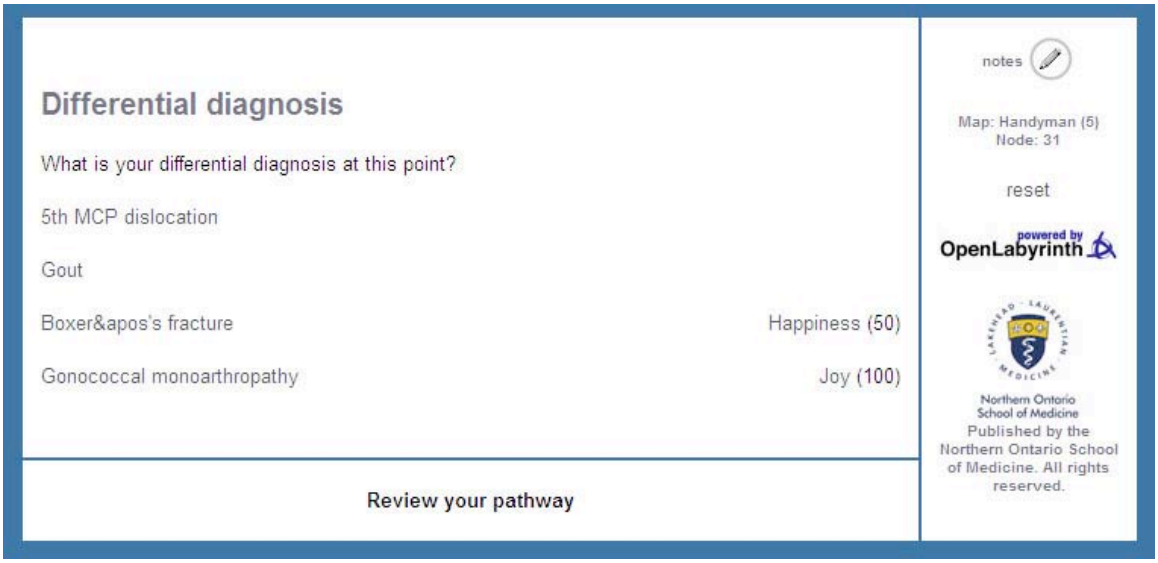


Figure 3: a typical labyrinth screen

2.2: Keys

In addition to making a Labyrinth more or less secure using Labyrinth security you can also require your users to enter an arbitrary text key to activate a Labyrinth. To turn on the use of keys set the labyrinth security type to "keys (a key is required to access this Labyrinth)" in the global editor and use the 'edit' link by the security type select to create one or more keys. A key can be any kind of text string including variations such as '6t4g45' 'green for go' and '85A94W8BA9445'.

When a user tries to run a labyrinth they will be challenged to enter a valid key and they won't be able to start until they do so.

2.3: User Interface

There may be a number of different elements on display (see figure 4) including:

- Title: every node has a title, which is typically displayed at the top of the page.

- Message: although not mandatory almost all labyrinth nodes will have some kind of textual message for the user. Typically that will either describe the consequences of having selected the current node. The message can change depending on what rules have been tripped when you entered the current node. For instance if your score hit zero you would be asked to restart the activity.
- Linked options: the way to traverse a labyrinth is to click on one of the available options. These will usually show the title of the node you are inking to although different text or an image icon may be provided instead.
- Review pathway taken: unless disabled in a particular skin a clickable track of the user's pathway through the labyrinth since you started is available. Click on a link to go back to that point – note that this does not roll back the track of which nodes have been visited, every action is recorded in a session.
- Media elements: because OpenLabyrinth provides every node with containers for HTML code any media element that can be displayed in a regular webpage can also be displayed in OpenLabyrinth. This includes images, video, audio, or programmatic objects and animations (such as Flash or Java).
- Services: if a service has been instantiated globally (or at a particular node) an icon will allow you to launch that service (typically in a pop-up window), these can include information notes and DDX services.
- Counters: for each counter with its visibility set to 'show' a note of the item name and its current value is displayed. If a counter function is encountered (which changes the value for any given counter) this is also displayed. The counter text is clickable to launch a pop-up that gives more information about that counter.
- Metadata and score: although not all skins show these, many do. This shows the current labyrinth and node ID, and your current score (if used).
- Reset link: this ends your present session and restarts you in a new session within the same labyrinth.
- A link to OpenLabyrinth home page: clicking the OpenLabyrinth icon returns you to the home page.
- Other graphics, links, tools and text may also bee displayed depending on the current skin.

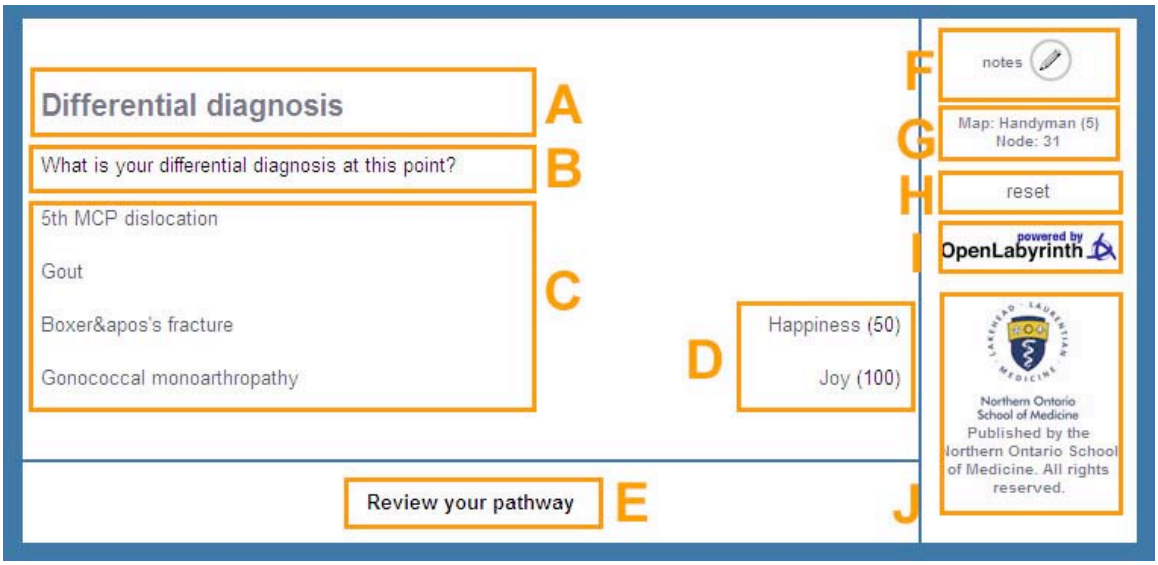


Figure 4: a typical labyrinth screen's elements: A: Node title; B: Node message/content; C: Links/options; D: Counters – label plus current value; E: Link to review nodes viewed in the current session; F: Open note taker; G: Current labyrinth and node information; H: Reset/restart current labyrinth; I: link to OpenLabyrinth home page; J: Skin-specific graphics and text.

2.4: What happens next …

What the user experiences depends on the design of the labyrinth they are playing and the choices available within it but typically a user makes decisions as to which path they shall take and these decisions have different consequences depending on the rules set on the nodes they pass through. Scores and counters may go up or down, paths may be dead ends or choices may end the current activity, while other paths will be successful. Therefore when you are playing a labyrinth you should think carefully about the options available to you, keep an eye on any counters or timers in the activity and follow the instructions and hints given you. Some skins support multiple user modes where services such as information can be turned off to make the activity more challenging.

2.5: Tracking and Feedback

Every option selection (or ‘click’ - along with the current score, timer and counter values) is recorded as you work through a labyrinth. This tracking supports the pathway review function and any conditional and feedback rules as well as being able to generate a report on how the user did within the activity.

If the current labyrinth has been set to provide a feedback report then at some point the user will be presented a link that says “end session and view report” – this will end the current session and provide a comprehensive feedback report – see section 5 for more information.

If you are logged in, on the OpenLabyrinth home page there is a ‘My OpenLabyrinths’ link from which you can view a list of every OpenLabyrinth you have started, behind which there is a user session report that shows what path was taken, how much time elapsed between entering and leaving the node and the varying level of any counters. A histogram of this data is also available.

3: Creating a Labyrinth

There are four ways to create a labyrinth within OpenLabyrinth; stepwise manually, using a tool called 'Vue', importing a MedBiquitous virtual patient package or duplicating an existing labyrinth.

3.1: Creating a Labyrinth Manually

This is where each node is entered manually, one at a time, along with the links, rules etc. The steps for authoring and editing are very similar other than for authoring you need to create a labyrinth first. To do this first click the 'add a new Labyrinth' link (available to logged in users only) and then fill in the form to set the new labyrinth's global properties.

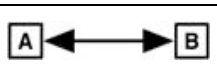
Once you have created the new labyrinth you can then start building it up by adding nodes, links between nodes and counters, files, rules and other dynamic properties. A single root node will have been created as part of the labyrinth but all other nodes, links, rules etc will need to be added manually – see section 4 on editing a labyrinth for more details.

3.2: Creating an OpenLabyrinth Map using Vue

Vue is a Java-based visual concept-mapping tool from Tufts University that can be downloaded (for free) from http://vue.uit.tufts.edu/ for both Windows and Mac. You can use it to create designs for labyrinths by creating boxes to represent nodes and the links between them. Although Vue supports many other features only the boxes (converted to nodes), text in the boxes/nodes and the links (between nodes) will be imported, everything else will be ignored by the parser.

There are a number of issues to consider when using Vue to design for OpenLabyrinth:

- Nodes and text: the colour, font, box shape and on-screen location are all ignored on import to OpenLabyrinth but they can be used to help with the design process. For instance different sections can have different colours.
- Links: When you create a Vue map for upload to OpenLabyrinth ensure you make your arrows between boxes point in the right direction as these are parsed in the upload process - directionless arrows are interpreted as bidirectional (from A to B and from B to A). Note also: this import process is currently only one-directional, once a Vue map has been uploaded to OpenLabyrinth it cannot (as yet) be exported and reopened in Vue.

Arrow type		Import result
Non-directional		A link from A to B and a link from B to A
One way back		A link from B to A
One way forward		A link from A to B
Bidirectional		A link from A to B and a link from B to A

- Pictures, hyperlinks and other Vue properties and objects are not imported to OpenLabyrinth.

When you import from Vue the text in each box is taken as both the new node's title and content. You can either specify the new labyrinth's name on import or use the default of the globally unique ID assigned to the new

labyrinth, for example “VUE_upload_126162A6-2BEB-4198-8D5B-4B093D60579E”. Either way you can subsequently change this and set other properties using the global editor.

You can choose whether or not to use verbose new node naming. With verbose naming turned on e ach node is named with the node number allocated in Vue using square braces to indicate that it hasn’t yet been edited, for example “ID=[2]]]] - see the patient”. Although this means that every node needs to be edited this ensures that the content and setup of the node is done properly. Alternatively you can turn verbose logging off and up to the first 50 characters of the Vue node text will become the new node’s title.

For more information on using Vue see the authoring guide at http://vue.uit.tufts.edu/userdoc/maps.cfm

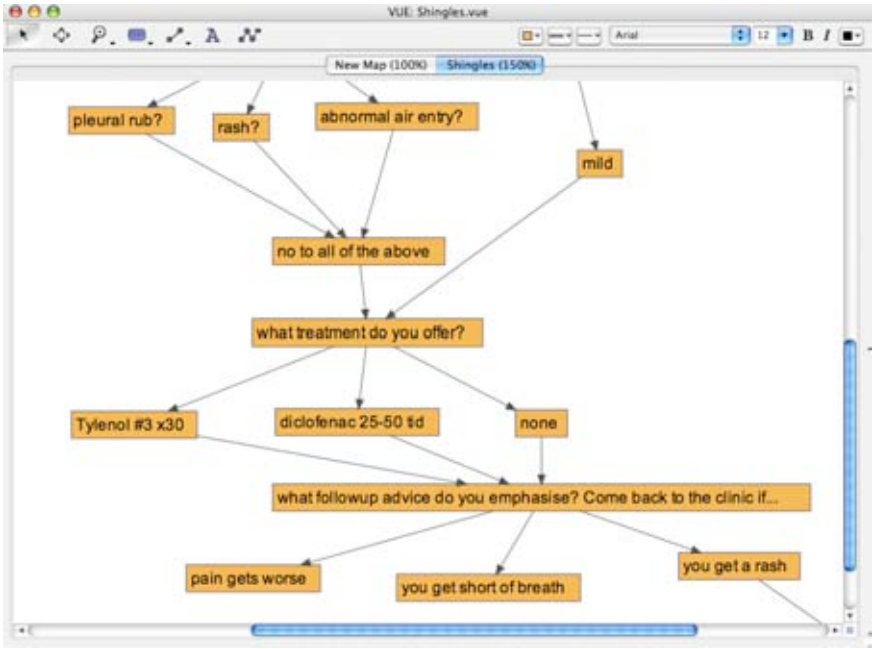


Figure 4: a screen grab of a virtual patient activity created in Vue.

3.3: Creating a OpenLabyrinth Map by Importing a MedBiquitous Virtual patient Package

OpenLabyrinth can create new labyrinths by importing MedBiquitous Virtual Patient packages. The package and the import process are described more fully in section 6.

3.4: Creating a Labyrinth by Duplicating an existing Labyrinth

Any labyrinth you have edit access to can be duplicated as a template for a new labyrinth by clicking its ‘duplicate’ link on the editor page. A basic copy of the original labyrinth is created (called “Copy of …”) allowing you to change any aspect while keeping the original untouched. Note that duplicating just takes the basic structure and does not import files, rules or other additional properties.

3.5: The New Labyrinth

All four of these methods do the following:

- Add the ID of the current user as an author of the new labyrinth
- Set the new labyrinth security to ‘private’ – this means it is listed in the ‘Labyrinth’s I am Authoring section on the home page
- Set the labyrinth type to ‘maze’
- Set section browsing to ‘off’

4: Editing in OpenLabyrinth

All aspects of a labyrinth can be edited by anyone who is logged in with edit permissions for that particular labyrinth. Simple content editing can be carried out within a node as the labyrinth is being played while more advanced features are available through the labyrinth editor.

4.1: Inline Editing

The title and content of a node can be edited from within that node if the current user has authoring rights to the current labyrinth. Click the link saying 'turn editing on' to switch into inline editor mode. You will be able to change the current node's title and content from here or click directly to the more advanced editing tools (see figure 5).

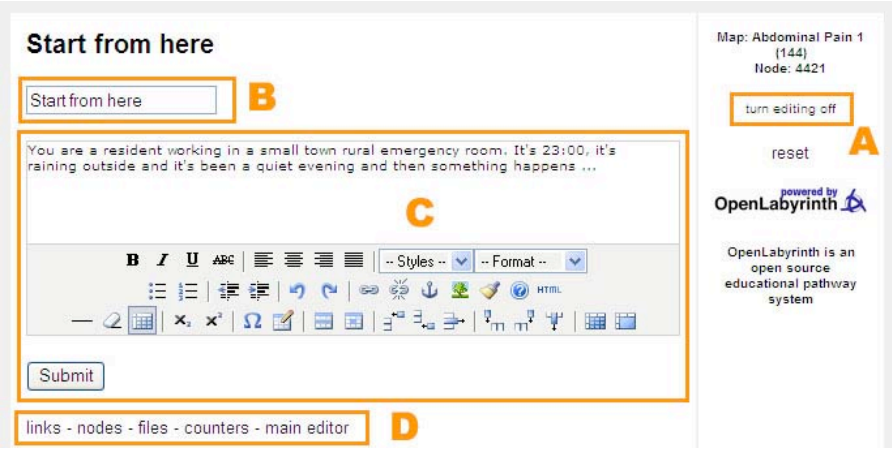

Start from here
Start from here
B
You are a resident working in a small town rural emergency room. It's 23:00, it's raining outside and it's been a quiet evening and then something happens ...
C
-- Styles --
-- Format --
Submit
links - nodes - files - counters - main editor
D
Map: Abdominal Pain 1 (144)
Node: 4421
turn editing off
reset
A
powered by OpenLabyrinth
OpenLabyrinth is an open source educational pathway system

Figure 5: inline node editing: A is the link to turn editing on and off, B is the field to change the title, C is the field to change the text, and D is a series of links to the main editor tools

4.2: Editor Functions

When you click 'edit' you are taken to a screen (see figure 6):

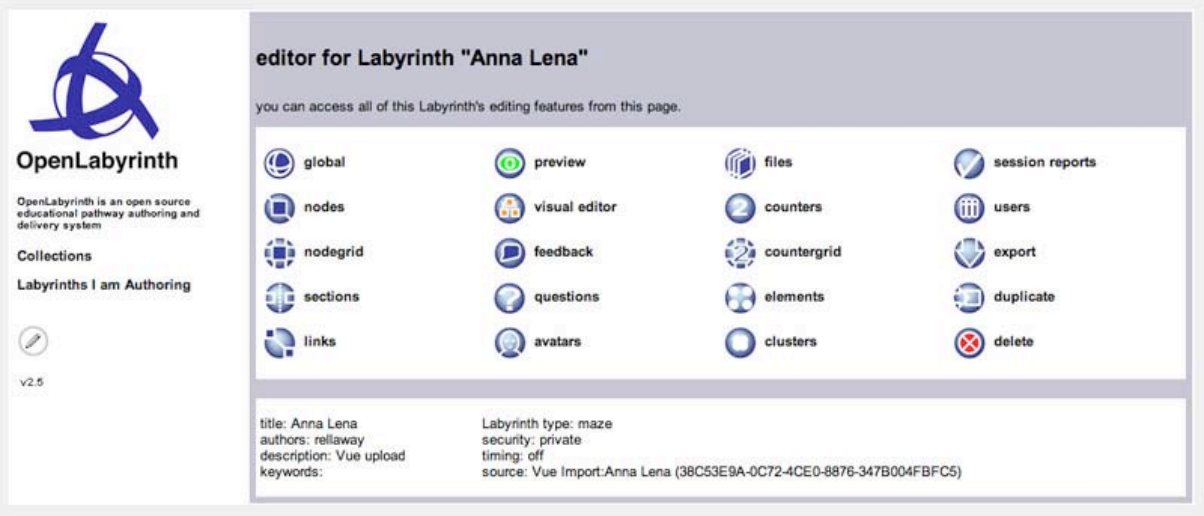


Figure 6: the OpenLabyrinth map editor

There are 20 main editing functions for any given labyrinth:

1. Global properties - this is a duplicate of the form used to create a map manually
2. Nodes – you can add nodes or edit any existing nodes from here
3. Nodegrid – you can edit all of the node titles and contents within a single Labyrinth at once
4. Sections – you can create arbitrary sections for grouping nodes together and assign nodes to these sections from here.
5. Links – you can add links or edit links from here
6. Preview – this launches the map in a new window
7. Visual editor –inline visual node and link editor
8. Feedback – you can create and edit feedback rules from here
9. Questions – embed formative questions for tracking and evaluation
10. Avatars - add and edit different avatars for the current labyrinth
11. Files – you can upload and manage any files you need in your map from here
12. Counters – you can add and edit counters from here
13. Countergrid – you can see and edit all counter functions for all nodes in a Labyrinth at once
14. Elements – you can add and edit data elements from here
15. Clusters – you can add and edit data clusters from here
16. Session reports – all user sessions for the current Labyrinth - see administration section on reporting services
17. Users – you can add or remove users (both authors and learners) for the current Labyrinth from here
18. Export – this exports the whole labyrinth either in the MedBiquitous Virtual Patient (MVP) data format or the Vue XML file format – see section 6
19. Duplicate – duplicates the current labyrinth
20. Delete – deletes the current labyrinth

4.3: Global properties

These are the properties that structure the whole labyrinth including:

- Title, author credits, keywords and description: these are free text entries to set general metadata properties for this particular map.
- Map type:
    - Maze and Algorithm – these only use one message box so that the use of scores is not advised for these labyrinth types, counters should be used instead. Maze is the default type.
    - Game – uses scores to control messages –deprecated from v2.08 onward
    - Key feature problem – enables additional assessment functionality
- Skin selection: a labyrinth can be skinned to appear in a range of different visual styles – you can select from any of the existing skins. Note that some skins have some OpenLabyrinth features disabled. See section 9 on customizing OpenLabyrinth for more information on developing and using skins.
- Score properties: the starting and threshold value for scores can be set here (integers only), as can the units label for the score.

- Timing: whether the map uses a real timer and the time delta (time available) set in seconds (integers only).
- Security: can be set – see table 1 for an outline of the settings and what they mean:

Security type	View/run	Edit	Duplicate
Open	Yes	Only if logged in and registered as an editor for the particular labyrinth	Only if logged in and registered as an editor for the particular labyrinth
Closed	Only if logged in		
Private	Only if logged in as an editor for the particular labyrinth		
Key	Requires a text-based key to run		

- Section browsing: this controls how the node sections are shown to the user. The choices are: don't show, visible, navigable (clickable).

4.4: Nodes

To view the nodes in the current map click the ‘nodes’ link in the main editor. This node edit screen lists all of the nodes in the current map – first those allocated to a node section and then all those that are unallocated. Clicking on the title of a node will preview it, clicking on ‘edit’ will launch the node editor and clicking on ‘links’ will launch the link editor. There is a link at the top of the node listing page to let you add a new node.

Whether you add or edit a node this will launch the node editor, which has the following features:

- Toggle html and WYSIWYG editors: there are two editing modes. The first (and default) mode is in HTML view where text and HTML code is entered directly into the title, content and info fields, the alternative is a WYSIWYG (what you see is what you get) editor that provides an interface somewhat akin to a word processor. In OpenLabyrinth this is provided by the TinyMCE component[1]. There are links at the top of the page that let you toggle between these two modes. Click on the ? icon in the WYSIWYG editor for information on how to use it (see figure 7).

Figure 7: the WYSIWYG tool bar

- Node title: this is both the title displayed in the lists of nodes and at the top of the page and the default text of any link to the node (although this can be overridden – see links section).
- Node content: This is what is shown to the user and is where narrative, images and instructions are added. Depending on the global setting for map type there are different editor boxes for node content. If the map is set to be a ‘Game’ this uses scores to control display between three content boxes: green, orange and red. Content from the green box is shown if the score is above the threshold (set in the global properties) and no other rules have overridden it. Content from the orange box is shown if the score is at or below the threshold (set in the global properties) and greater than zero and no other rules

[1] TinyMCE is a platform independent web based Javascript HTML WYSIWYG editor control released as Open Source under LGPL by Moxiecode Systems AB. Copyright © 2003-2006, Moxiecode Systems AB, All rights reserved. For more information visit the TinyMCE website at http://tinymce.moxiecode.com/

have overridden it. Content from the red box is shown if the score zero or below. If the map is set to 'Maze' or 'Algorithm' then there is only one content box. Note that to add a media resource such as an image you need first to upload the file and then copy and paste its wiki-style reference into the node content box where you want the file to appear (see managing files section).

- Info content: additional supporting content can be added in this field. If there is any content in the info box for a node then an info button will render at runtime that launches a popup window containing the information. This would typically be used to provide supporting factual information, commentary or advice from a character such as a tutor or links to other materials and content outside OpenLabyrinth.
- Node counter functions: for every counter created this is where they can be dynamically changed. You can leave this blank or use one of '+' or '-' or '=' plus an integer. For instance '+5' adds 5 to the current counter while '=6' sets it to 6 no matter what it was before.
- Exit node probability settings: this toggles on off whether just one of the linked nodes will be presented at random or all of them presented at once.
- Conditional rule settings: this allows you to set conditional rules for the current node. These rules specify what nodes need to have been visited before the current one can be accessed. When creating a conditional rule a message to the user is specified along with a Boolean statement of which nodes are required. For instance {1}AND({2}OR{3}) requires the user to have visited node 1 and either nodes 2 or 3 before accessing the current node. Editing a conditional rule deletes any previous rule requiring it to be reset.
- Link function style: this changes how the linked options are displayed to the user:
    - text (default) – each choice is shown as a plain text hyperlink.
    - dropdown – each choice is an option in a drop down list.
    - dropdown + confidence – each choice is an option in a drop down list with a second drop down to let the user select how confident they were at making the selection.
    - type in text – user types in what they think the option should be and if (after the first 3 letters are entered this matches one of the available choices then that choice is selected.
- Node priority: this flags whether the current node must be avoided or must be visited – this is used in the session reporting and feedback.
- Root node: this sets the current node as the root (starting point) node for the labyrinth.
- Link to end and report from this node: this is off by default. If turned on a link is added to end the current session and get feedback – see feedback section for more on this.
- Node score function: this can be used to change the score. You can leave this blank or use one of '+' or '-' or '=' plus an integer. For instance '+10' adds 10 to the current score while '=80' sets it to 80 no matter what it was before.
- Undo: this allows users to undo a node they have visited by removing it from the session track. In any given node scroll down to "enable undo links" and select whether this feature should be on or off for this node.

4.5: Nodegrid

Sometimes you just want to edit the content of all of the nodes in one go. That is when you use 'nodegrid'. Basically it provides a basic text box editor for the title and body of every node in a labyrinth for every node in a labyrinth.

4.6: Sections

Node sections are a way of organising nodes into logical groups. They can be used to help authoring, particularly where there are a great many nodes or several nodes have the same title. They can also be used to create a menu to help users browse through a labyrinth.

- You can add and edit node sections and assign nodes to node sections from ‘List/edit this labyrinth’s node sections’ link on the main editor page.
- You can add a node section by typing a label into the form at the bottom of the node sections page and clicking submit.
- You can edit an existing node section by clicking on the ‘edit’ link next to its name on the node sections page (which also lists the nodes assigned to each section). This provides a list of the current nodes in the section that allows you to order them and remove them from the current section. You can also add any unassigned node to the current section. Note that a node can only be assigned to one section at a time.
- You can control how the node sections are shown to the user. The choices are: don't show, visible, navigable (clickable). In the latter the section label becomes a hyperlink to the first node in the section.

4.7: Links

The links editor in a map lists every node in the left hand column and every link from that node in the right. Every left hand node entry allows you to edit its particular links or preview it. Every linked node entry on the right allows you to go to that particular node’s entry in the left hand column or preview it.

The editor for a specific node’s links allows you to:

- Change the type of linking from the current node: there are three kinds of node linking that can be set here:
    - Ordered: this allows you to specify the order that links will be shown. This ordering is set in the current link editor using numeric dropdowns per link – they evaluate low-high.
    - Random order: this means that the order of the available links from the current node will be randomised every time the node is loaded.
    - Random select: this means that just one of the available links will be randomly selected – note that this property can also be set in the node editor.
- Edit current links from the current node: this allows you to order links (if linking type has been set to ‘ordered’), delete links or edit them. If you are editing a link the form looks very similar to that for adding new links – see next section.
- Add a new link to the current node: this allows you to select a node to link to from a dropdown list of every node in the current map not already linked from the current node. You can also (optionally) set alternative text for the link (the default is the target node’s title) or set a path for an image or icon to be used instead of a textual link.
- Add a counter function to a link – this will only activate when the link is clicked. This is different from the previous OL model of counter functions only being available on the node.

4.8: Preview

This starts the labyrinth running in a new window.

4.9: Using the Visual Editor

The visual editor is a Flash-based tool that allows you to add, edit, move and delete nodes, links and node content rather like Vue but inline to OpenLabyrinth so that edits are made direct to the Labyrinth and can be previewed at once. You launch the visual editor from the editor pane which opens in a new window.

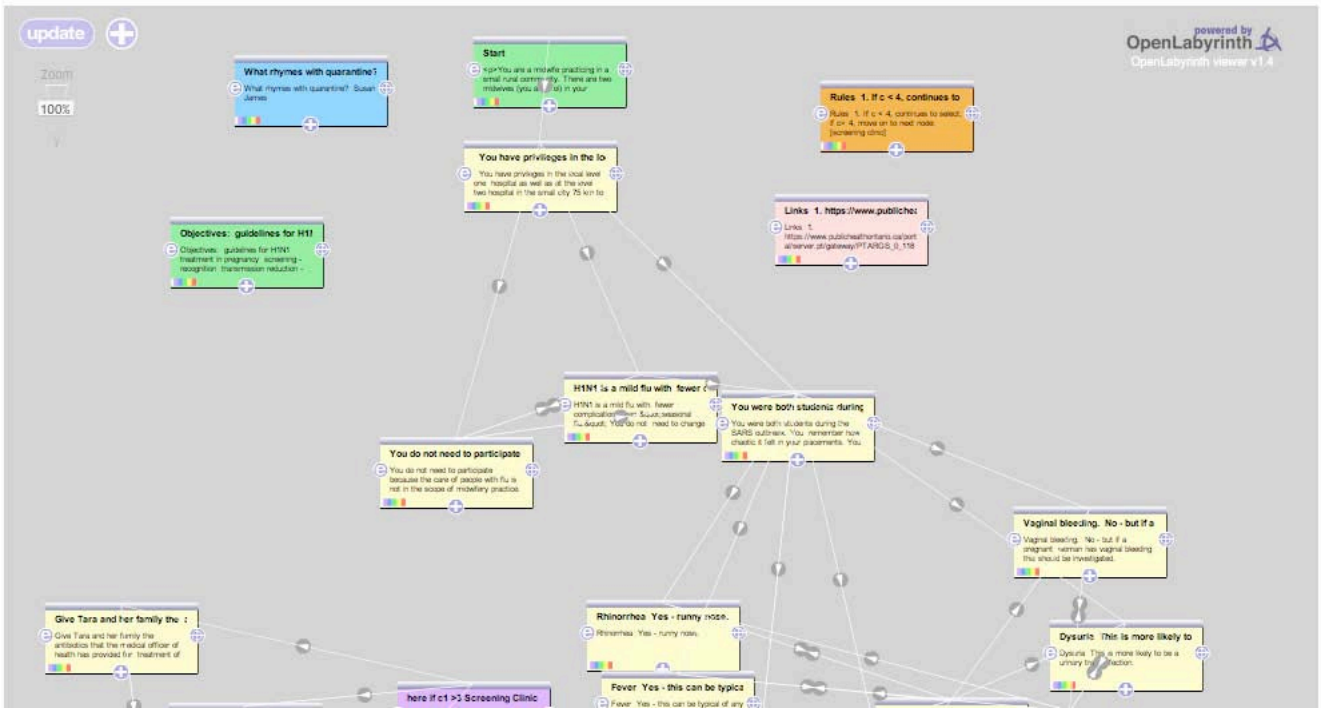

update
Zoom
100%
powered by
OpenLabyrinth
What rhymes with quarantine?
Start
Rules 1. If c < 4, continues to
You have privileges in the lo
Links 1. https://www.publiche
Objectives: guidelines for H1
You do not need to participate
You were both students during
Vaginal bleeding. No - but if a
Give Tara and her family the :
Rhinorrhea Yes - runny nose.
Dysuria This is more likely to
here if c1 >3 Screening Clinic
Fever Yes - this can be typica

Figure 8: the visual editor

zooming: click and drag the zoom control in the top left of the window - the zoom amount shows in the slider - the default is 100%. Multitouch zoom (two fingers) can also be used if your computer supports it.

panning (moving around): click and drag in an open area to drag the workspace around - a newly imported labyrinth may need to be dragged into view - first zoom out to find it, drag to the centre and then zoom in.

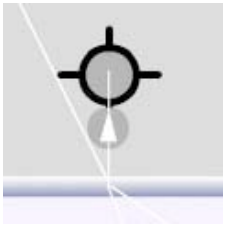
saving your work: the visual editor needs to be updated to save changes to the database. Either click the update button in the top left of the screen or the update buttons in the node or link editors. Updating also clears occasional odd behaviours.

moving node boxes: click and drag in the top bar in a node box to move it around the screen. All links to or from the node box will move at the same time.

editing text in node boxes: click on the title or body text of a node box to start editing it. Note that the viewer needs to be updated before any changes are added to the database.

adding node boxes: click on the + icon at the bottom of a node box to add a new node linked from the one you clicked. Alternatively click the + icon at the top left of the editor to create a new node not linked to another node. Note that the viewer needs to be updated before any changes are added to the database.

deleting node boxes: click the 'e' icon on the node box to be deleted, select the delete button and then click update.



adding links: click on the target icon on the right hand side of a nodebox to create a new link. Click and drag the target on to the node to be linked and let go. A new link has been created. Note that the viewer needs to be updated before any changes are added to the database.

editing links: click on the triangle icon in the middle of a link to edit it. Select one of 'two ways', 'backwards only', 'forwards only' or 'no link' and then click update. Note that setting a link to 'none' deletes that link.

change a node box background colour: click on a colour slice in a node box to change the background to that colour.

Please also note the following:

- From this version (2.5) Vue map imports include the X, Y and RGB properties of every node. Previous imports and any other node content will not by default have these properties and will be shown in a grid format.
- Updating the viewer will save any changes. It is recommended that this is done regularly, particularly when creating new nodes to ensure they are saved and managed properly.

4.10: Feedback

This lets you control how the feedback will be presented to the user at the end of their session. See separate section on this topic.

4.11: Questions

This lets you control how the feedback will be presented to the user at the end of their session. See separate section on this topic.

4.12: Avatars[2]

Avatars are animated simple images of the characters you might want to include in your Labyrinth either as passive representations of the characters in your narrative or taking part via speech or thought bubbles. There can be any number of avatars per labyrinth – for instance the same character in different settings and saying or thinking different things or perhaps many different interacting characters.

Each avatar can be customized as follows: Sex, age, eyes open or closed, outfit, mouth shape, the colour of their outfit (for some outfits only), their nose type, hair type and colour, three different layers of accessories such as wounds, glasses, bandages etc, skin tone and colour, background colour, background scenery, background weather and the kind of speech or thought bubble used and what text should go in it.

Once created each avatar has a reference that looks like [[AV:123]]. Copying this tag and pasting it into the contents of a node or info box and allows it to be incorporated and reused anywhere in the current Labyrinth. You can duplicate an existing avatar for instance to create a series around a single character, and you can edit them and delete them. See figure 10.

Figure 10: the avatar editing screen

[2] Thank you to Stewart Cromar at the University of Edinburgh for developing and sharing the code and media to allow us to include this feature in OpenLabyrinth.

4.13: Files

You may wish to add images, sounds, videos, documents, spreadsheets or other discrete files to your OpenLabyrinth map. To manage your files click on the ‘list/edit this OpenLabyrinth's files (images etc)’ link in the main editor. This launches the file manager window (see figure 8).

Figure 8: map files editor.

For each file uploaded into the current labyrinth you have:

- A wiki-style file reference: this takes the form of [[MR:xxx]] where MR indicates that this is a media resource and xxx is the unique file ID assigned to the file on upload. By pasting the reference into a node content box the file will be displayed at runtime.
- A resource preview: this just shows what the resource looks like (images only).
- A metadata view and editor: this shows basic metadata for the resource, allows you to edit the metadata and it allows you to delete the file from the current labyrinth.

In addition you can upload a new file by choosing it and clicking the upload button (see table 2 for list of supported file types). Once a file has been uploaded it should be edited for its metadata (this will allow for both better control of the resource as well as registration within the Media Resource MVP service – see section 5.2). Note that you should always ensure that any material you use (both text and images) is not covered by any copyright or consent restrictions. Liability for inappropriately used materials rests with the author.

File Type	Display	Extension	Notes
JPEG image	Inline	.jpg, .jpeg	JPEGs and GIFs are the only supported image formats in OpenLabyrinth
GIF image	Inline	.gif	
Acrobat PDF	Link	.pdf	PDFs may be created from many applications including Adobe Acrobat
Shockwave Flash	Embed	.swf	Runtime media files from Adobe Flash
Microsoft Word	Link	.doc, .docx	Standard document formats
Microsoft Excel	Link	.xls, .xlsx	
Microsoft PowerPoint	Link	.ppt, .pptx	
Rich Text Format	Link	.rtf	
QuickTime video	Embed	.mov	Video formats
MPEG-4 video	Embed	.mp4	
Windows Media	Embed	.wmv	
Real Stream (RAM)	Embed	.ram	
Real Stream (RPM)	Embed	.rpm	
Flash video	Embed	.flv	
MP3 audio	Embed	.mp3	Audio formats
WAV audio	Embed	.wav	
AAC (m4a) audio	Embed	.m4a	

Table 2: file formats supported by OpenLabyrinth

4.14: Counters

Counters are comprised of a label and a dynamic integer value, which can be dynamically changed as a user works through a labyrinth. There can be any number of counters and each of these counters can have any number of rules that can be triggered by a counter's value.

Counters need to be created globally for a map. To create a new counter or edit an existing one click the 'counters' link. This opens the counters editor, which lists each existing counter with links to edit, preview or delete it along with a link to create a new counter. Adding or editing a counter opens the counter editor window (see figure 13).

The counter editor allows you to define/change:

- Counter title: this is the label shown for the counter.
- Counter description: an optional text description of what the counter is and what its purpose is.
- Path for a counter icon: an optional path for a graphical icon for this counter.
- The starting value for the counter

Once created each counter will be displayed (except on some skins) to the user indicating its title and current value. If the value is changed at a particular node that value change is also displayed. Clicking on a counter link will launch a popup window with full details about that counter. Changing the value of a counter as a user moves through a map is set in the node editor which has a function box per counter: you can leave this blank or use one of '+' or '-' or '=' plus an integer. For instance '+5' adds 5 to the current counter while '=6' sets it to 6 no matter what it was before.

Counter rules can be added from the editor for a particular counter. Each rule consists of the following components:

- An integer value
- An operator: equal to, not equal to, less than or equal to, less than, greater than or equal to, greater than
- An action if the condition is met:
    - Go to one of the nodes in the current labyrinth Note that the counter value should be reset at the target node or the program will loop
    - Show a message in place of the default node message

For example: if counter 3 is greater than or equal to 50 then show message "well done".

From this versions counter functions can also be set on links. This means that the value of a counter can be changed based in the link selected rather than the node entered.

From this version the visibility of each counter can be controlled by setting it to 'show' or 'do not show'.

4.15: Countergrid

Countergrid shows a function box for every node and every counter so that counter functions can be set all in one go.

4.16: Data Elements

OpenLabyrinth supports the MedBiquitous Virtual Patient (MVP) data specification, a key aspect of which is the use of data elements. OpenLabyrinth supports the following MVP element types, each of which has a different structure:

- VPDText
- PatientDemographics
- AuthorDiagnoses
- MedicationInterviewItem
- PhysicalExam
- DiagnosticTest
- DifferentialDiagnosis
- Intervention

To use OpenLabyrinth data elements:

1. Select ‘data elements’ from the editor menu. This will give a list of all the current data elements and a link to create a new element
2. You can edit or delete any of the data elements
3. On the new element page select the type of element you want to create from the drop down menu – this will load a form to be completed to create the element

Using a data element in a labyrinth involves pasting its tag into the content for any given node. The tag has the format of ‘[[VPD:’ then the element’s ID and then ‘]]’, i.e. [[VPD:ER9M0MC]] – see figure 9. You can also use data elements in data clusters.

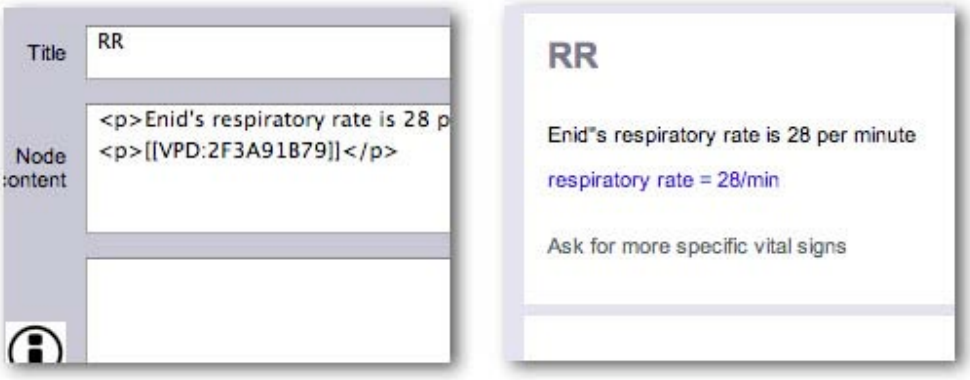


Figure 9: an embedded data element in the node editor (left) and how it renders on screen (right)

4.17: Data Clusters

Integrating elements – there are two ways of linking in VPD or MR elements to an activity node: as individually embedded elements or as a collection of elements via a data cluster.

Click ‘clusters’ on the editor menu – this lists all of the current clusters. You can edit the contents of a cluster or delete a cluster or you can create a new cluster. Within a cluster you can add or remove data elements or media elements (such as pictures) and change the order in which they’re shown to the user.

4.18: Session reports

This lets you view all of the sessions run on the current labyrinth. See separate section on this topic.

4.19: Users

A map’s authors are the only ones who can edit it and if the map’s security is set to private they are also the only ones who can see it. By default the user who created a map (by any of the three creation methods) is an author

on the new map. Additional authors can be added (or removed) using the map's author editor which is accessed by clocking on the 'list/edit this OpenLabyrinth's authors' link in the main editor. This provides a grid of all the registered OpenLabyrinth authors with a tick box by each one that can be selected to add the user as an author of the current map or deselected to remove them from the current map. Note that you cannot add or remove yourself as an author.

Learners can also be added to a map so they can access it (but not edit it).

4.20: Export

There are two kinds of export – MedBiquitous/SCORM and Vue:

- You can export a labyrinth to the MedBiquitous Virtual Patient package format – see section 6 for more details. To create an MVP package click on 'export MVP' from the editor main menu, select the appropriate licence to release the package and then create and download the zip file.
- You can export the nodes, links and text content of a map to a Vue file, which can then be edited by a Vue editor. The same Vue file can then be resynchronised with the labyrinth map it came from which will update all of the links, nodes, text content and the X, Y and RGB properties.

4.21: Duplicate

Any labyrinth you have edit access to can be duplicated as a template for a new labyrinth by clicking its 'duplicate' link on the editor page. A basic copy of the original labyrinth is created (called "Copy of …") allowing you to change any aspect while keeping the original untouched. Note that duplicating just takes the basic structure and does not import files, rules or other additional properties.

4.22: Delete

You may wish to delete a labyrinth you have started. To do so click the 'delete this map' link on the main editor – you will be challenged whether you really want to delete this map. If you are sure that you do then click the 'go ahead and remove this labyrinth' button. Recognising that some people may wish to resurrect deleted maps they are not permanently deleted but disabled and held offline. Contact an OpenLabyrinth administrator to reinstate a deleted map or go to the database and change the mapEnabled flag to 'y' in the MAP table.

4.23: Author Notes

A simple note taker can be run for the authors of a labyrinth. Click on the pencil icon to load the author notes editor. This can be viewed and changed by any of the editors of any given labyrinth.

4.24: Key Feature Problems and Matching

If the labyrinth type is set to Key Feature Problem then any node within that labyrinth can be set to be a matching question rather than providing links. Turn matching on by going to any node in the current KFP typed labyrinth and scroll down to "add text matching", turn it on and submit the page. Go back and re-enter the node edit page and there is now an 'edit button' next to the "add text matching" buttons. Click edit to start adding different strings to be matched (up to 12 per question as well as the score for a match and whether the match is critical or not.

You can also set the following:

- counter controlled – this is the counter that is changed as a result of matching and adds the associated score to this counter

- strict [off][on] – this changes whether a string must be matched strictly or not – for instance if the match term is “cardiac arrest” if the user enters “cardiac” they will get a match only if strict is turned off.
- number of options for user – this is the number of text boxes and therefore tries the user has to submit candidate matches
- next node – this is the node that the user is taken to after the matching has been processed

In a matching-enabled node the user is presented with a series of text boxes and a submit button – see figure 11.

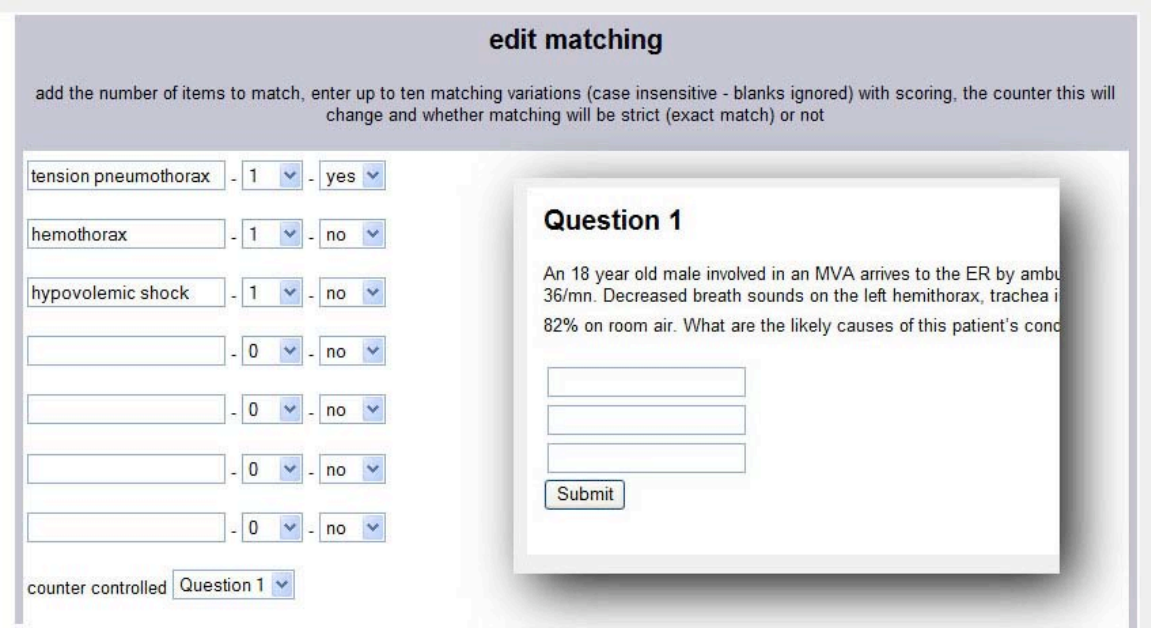

edit matching
add the number of items to match, enter up to ten matching variations (case insensitive - blanks ignored) with scoring, the counter this will change and whether matching will be strict (exact match) or not
tension pneumothorax - 1 - yes
hemothorax - 1 - no
hypovolemic shock - 1 - no
- 0 - no
- 0 - no
- 0 - no
- 0 - no
counter controlled Question 1
Question 1
An 18 year old male involved in an MVA arrives to the ER by ambu
36/mn. Decreased breath sounds on the left hemithorax, trachea i
82% on room air. What are the likely causes of this patient's conc
Submit

Figure 11: the matching editor and the way a matching question is presented to the user (in this case with three attempts)

5. Feedback and Reporting

As with any educational program a labyrinth is at its most useful when it can inform a learner how well, or how badly, they performed. It is even more useful when accompanied by suggestions about how they might improve their performance in future.

5.1: Session Reports

As has already been mentioned each labyrinth user session is tracked and is available to its authors as a report. A user session is started each time a user goes to a map's root node. The tracking involves recording each node selection along with the time and current score and counter values at that point. The reports are available in one of two ways:

- Users can see reports for every OpenLabyrinth they have run – this is in the 'My OpenLabyrinths' section linked from the home page
- Authors can see reports for every session within a particular map – this is in the 'user session report' section linked from the main map editor.

Each report consists of a list of nodes visited (representing the user's path through the map) along with the current score and how long they spent at the node (in seconds).

This allows a histogram to be drawn representing the session to be drawn up (see figure 12). The value of each counter is also recorded and is available as a plot (see figure 13).

The data can be downloaded as a CSV file for further analysis.

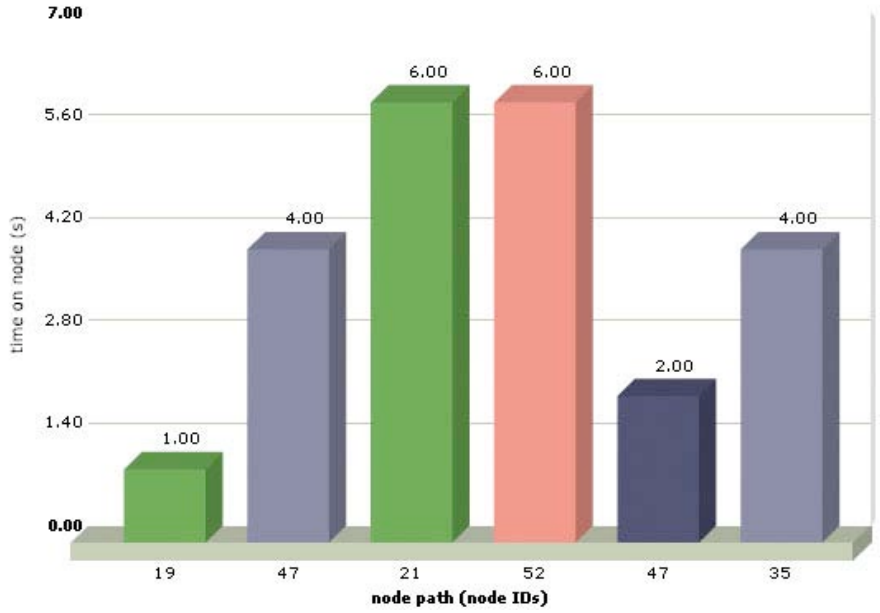


Figure 12: a typical OpenLabyrinth report histogram. In this session the user spent 6 seconds on nodes 21 and 52. Node 21 is a 'must visit' node (in green) and 52 is a 'must avoid node' (in red).

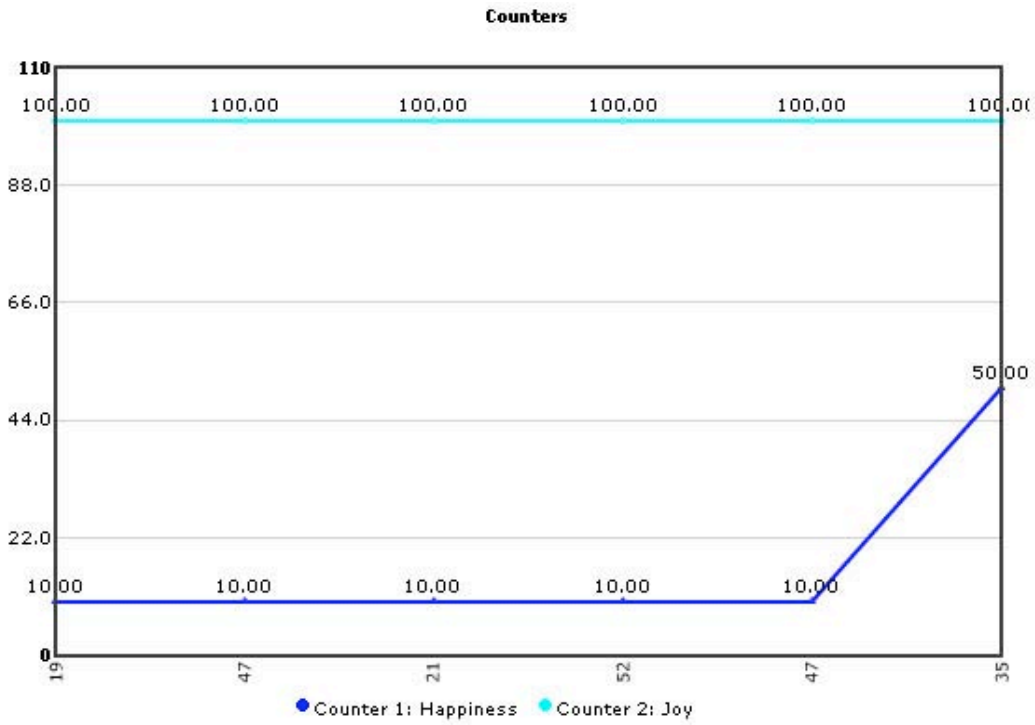


Figure 13: a typical counter trace – there are two counters here 'happiness' which started at 10 and rose to 50 on the last node and 'happiness' which remained at 100 throughout

5.2: Feedback Report

The user can also be given a feedback report. To do this first enable the node property of 'link to end and report from this node' for any node from which you want to allow the user to get their report. When the user clicks the report link they get the following:

- Metadata such as the user ID, the session ID and the labyrinth name.
- The start time and the time taken to complete
- The total number of nodes visited as well as the number of 'must visit' and 'must avoid' nodes visited
- General feedback irrespective of what the user has done
- Feedback in response to specific nodes visited
- Feedback in response to the number of 'must visit' and 'must avoid' nodes visited
- Feedback based on the time taken to complete
- Feedback: on the final values of any of the current labyrinth's counters
- The list of nodes visited
- The histogram of time spent per node
- The graph of counter values through the session

5.3: Feedback Options

User feedback can be configured as follows:

1. Click on the 'feedback' option in the editor menu
2. Set the general feedback to the user – for instance "That was a hard problem …"

3. Add feedback rules:
    a. Feedback in response to specific nodes visited – for instance “You chose to get an MRI, that was an expensive option given the circumstances …”
    b. Feedback in response to the number of ‘must visit’ and ‘must avoid’ nodes visited – for instance “You made 4 choices that should have been avoided …”
    c. Feedback based on the time taken to complete – for instance “You completed the task in less than 2 minutes, were you really thinking about what you were doing?”
    d. Feedback: on the final values of any of the current labyrinth’s counters – for instance “Your morale slipped below the critical point …”

6. Global Functions

In addition to the creation and running of OpenLabyrinth maps there are a number of OpenLabyrinth administration services including user management, reporting and import/export:

6.1: Users and Groups

All authors need to have a login to OpenLabyrinth. OpenLabyrinth super users have the ability to create OpenLabyrinth accounts using the link from the home page. Each account requires a username, password, full name and email address. This is where the user interface language is set for a given user. A user may also be given super user access.

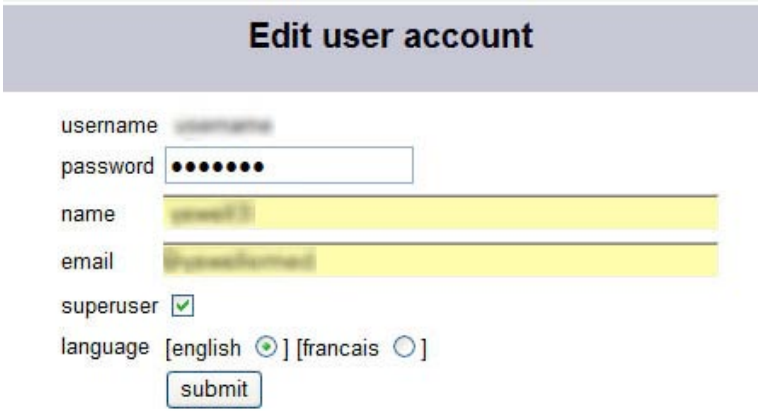


Figure 14: the add user screen

Groups are collections of users. The tools for creating groups and managing their membership are below those for users on the same page.

6.2: Language support

The user interface language is set in the user account creation or editing pages. If you change your own user language then you must logout and log back in for the changes to take effect. Currently there are just two supported languages – English and French. Note that the user guide is currently available only in English although a French translation would be most welcome. Note that the user interface phrases are stored in the "interface.xml" file sitting in the documents folder at the OpenLabyrinth root.

At present the French translation is likely to be pretty poor limited as it is to the author's memories of school French and the quality of Google Translate. Corrections and improvements are invited. Furthermore anyone willing to translate the 370 or so interface elements into a third or fourth language are welcomed and encouraged. Simply add a language tag at the top of the XML file – eg <language ID="KN" name="klingon" /> - and then add an additional element for each phrase – eg <phraseKN>qapla</phraseKN>. Return to the author for inclusion in the next release.

Figure 15: the interface.xml file that can be found in documents/interface.xml

6.3: Presentations

Groups of Labyrinths can be collected together as ‘presentations’ for instance as a course page or a bank of assessment items. To create a presentation click on the ‘presentations’ link on the home page, add the details for the presentation such as any text to be shown and user options and then submit. Edit a presentation to add specific labyrinths to it. Note that you must be an author on any labyrinth you want to include in a presentation – see figure 16.

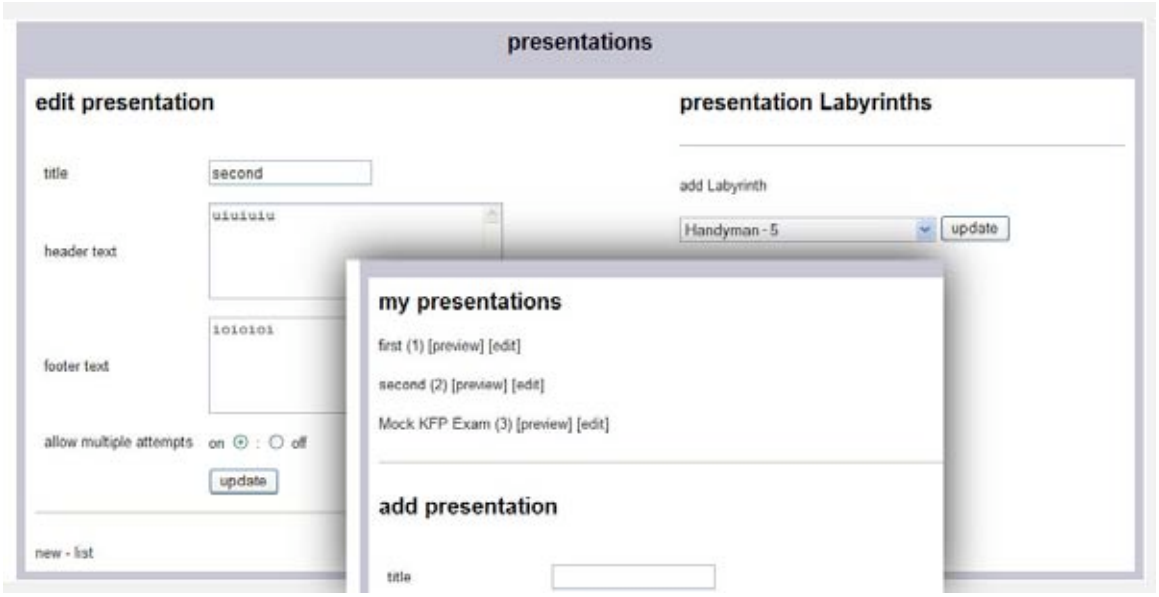


Figure 16: the Presentations authoring screens

6.4: Collections

This allows you to create a collection of different labyrinths. For instance, there may be a set on a particular topic or that use a particular approach. A labyrinth can be allocated to multiple collections.

6.5: MedBiquitous Virtual Patient Export

OpenLabyrinth currently exports to the MedBiquitous Virtual Patient XML format. To create a package, click the 'export MVP' link. This will run a script that creates a new folder, copies the required files into it, writes XML files for the various required components and then creates a zipped archive of the folder and its contents – the user is then presented with a link to the zip archive.

The key elements are labelled as follows:

A The Zipped package

B The IMS Manifest XML file that lists the contents of the archive

C The metadata XML file in LOM format

D Activity Model XML file

E Folder containing all of the media objects

F Virtual Patient Data XML file

G DAM XML file

The other files and folders are required objects for a SCORM package.

6.6: Vue Export and Sync

You can export the nodes, links and text content of a map to a Vue file, which can then be edited by a Vue editor. The same Vue file can then be resynchronised with the labyrinth map it came from which will update all of the links, nodes, text content and the X, Y and RGB properties.

6.5: Import

In a similar but reverse way to MVP export, OpenLabyrinth can create a new labyrinth by importing and MVP package. Follow the 'create' link on the OpenLabyrinth home page and then select 'MVP import' to upload an MVP package.

You select the zip archive, this is uploaded to a new temporary directory, unzipped, the XML files parsed and the data written into the database, files copied to new directories and when all the importing has been done the temporary directory deleted and a link to the new labyrinth presented to the user.

7. OpenLabyrinth Remote Services

7.1: Description

In addition to playing OpenLabyrinth activities within OpenLabyrinth itself you can also run them in a remote system such as a virtual learning environment or e-assessment system by using OpenLabyrinth Remote Services. These services use XML to send OpenLabyrinth node content to the remote client that then communicates back using simple URLs (see figure 18).

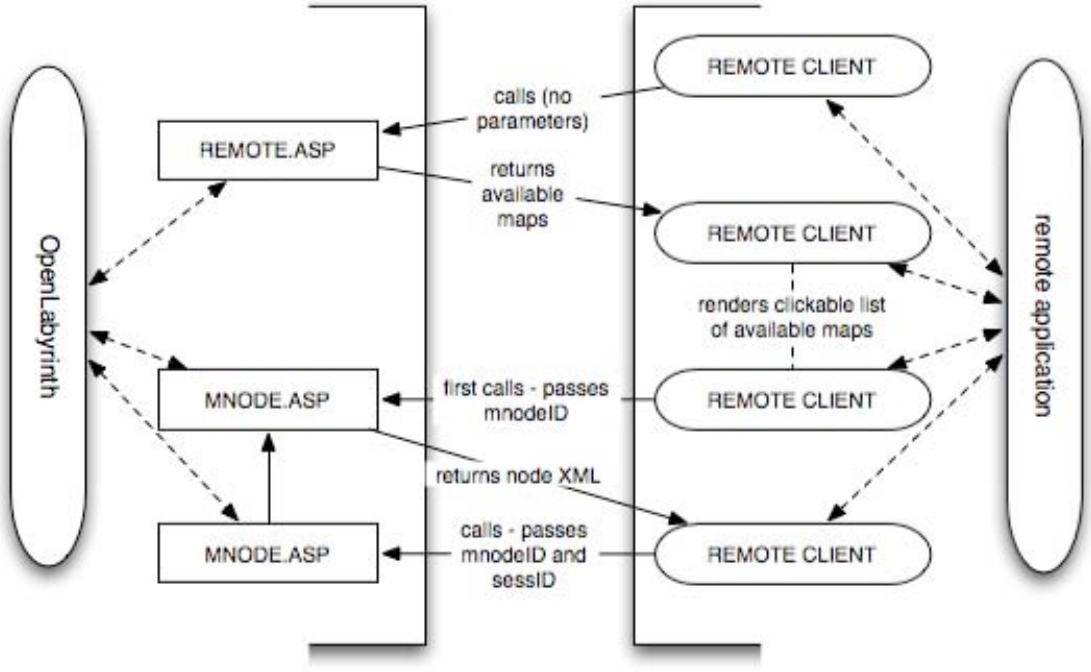


Figure 18: OpenLabyrinth Remote Services Architecture. OpenLabyrinth is on the left and the remote application is on the right hand side. The steps are:

1. *The remote client calls REMOTE.ASP in OpenLabyrinth*
2. *If the user credentials are correct or the remote client's IP is recognised then REMOTE.ASP sends back an XML file listing the available Labyrinth Maps*
3. *The remote client parses the incoming XML into clickable links to start each Labyrinth Map*
4. *When the user clicks on a link this sends a call to MNODE.ASP passing just the nodeID*
5. *If the call is authorised then MNODE.ASP returns the node XML package*
6. *The remote client parses the incoming XML so the user can work through the activity. Each click cycles through steps 4-6*
7. *As this is happening additional communication can run within each application*

7.2: Setting up OpenLabyrinth Remote Services

There are two ways a remote service can be called:

1. by passing user credentials in the remote GET string. The user needs to be a remote type user (i.e. not a superuser, author or learner account). To set this up:
    - create a remote user or reuse an existing one
    - add the remote user to any maps you want to be available in the remote service
    - call the remote service by adding hashed userID and password credentials (uid=xxx&pwd=yyy) using the cookieHash function in UTILITIES.ASP . There is a commented function in REMOTE.ASP that allows you to generate the hashed credentials
2. by registering a remote service. To set this up:
    - click on ‘remote services’ on the home page and then ‘add a service’
    - give the service a name and enter the IP address or range of the remote server. Leave box 4 or 3 and 4 blank to indicate a range of IP addresses, e.g. put 123 in box 1 and 45 in box 2 to accept any IP starting with 123.45.
    - once the service has been created then add Labyrinth Maps to the service by clicking ‘add/edit Labyrinths’ and adding them from the dropdown menu

7.3: Remote Services Components and Messaging

There are at least three discrete functions required at the client end:

1. Client list: this queries OpenLabyrinth for the OpenLabyrinth activities assigned to the current remote service and then formats and displays the results of the query
2. Client player: this interacts with the MNODE.ASP script in OpenLabyrinth to run the activity
3. Client remote services: these support additional OpenLabyrinth services like info boxes, counters and DAM nodes

In addition there may be local services layered on top of the remote OpenLabyrinth application. The components and their accompanying messaging flows are laid out in figure 19.

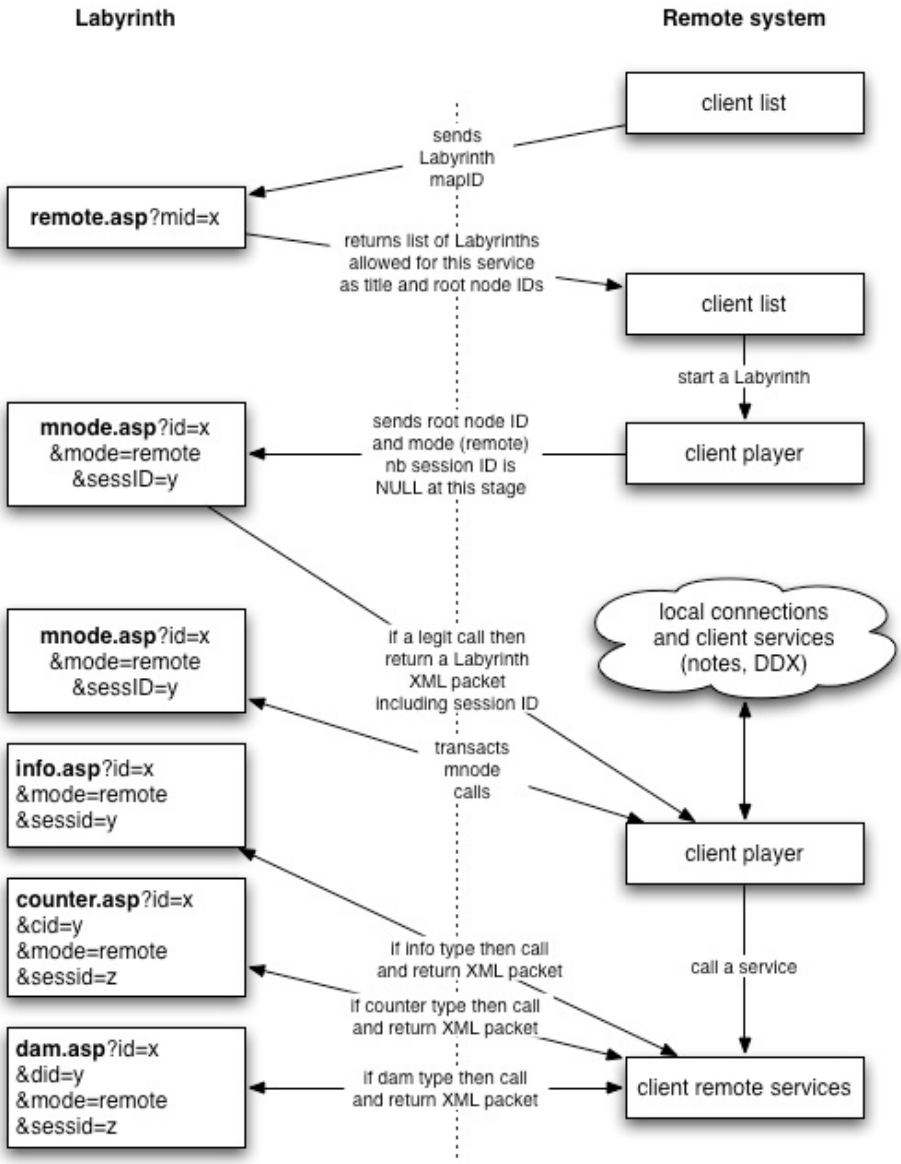

Labyrinth
Remote system
client list
sends Labyrinth mapID
remote.asp?mid=x
returns list of Labyrinths allowed for this service as title and root node IDs
client list
start a Labyrinth
mnode.asp?id=x &mode=remote &sessID=y
sends root node ID and mode (remote) nb session ID is NULL at this stage
client player
local connections and client services (notes, DDX)
mnode.asp?id=x &mode=remote &sessID=y
if a legit call then return a Labyrinth XML packet including session ID
info.asp?id=x &mode=remote &sessid=y
transacts mnode calls
client player
counter.asp?id=x &cid=y &mode=remote &sessid=z
if info type then call and return XML packet
call a service
if counter type then call and return XML packet
dam.asp?id=x &did=y &mode=remote &sessid=z
if dam type then call and return XML packet
client remote services

Figure 19: remote components and their interactions with OpenLabyrinth

7.4: OpenLabyrinth Remote Services Transactions

There are three transaction types in the remote services: OpenLabyrinthservice, OpenLabyrinth and service.

7.4.1: Transaction: OpenLabyrinthservice

This transaction is called by the client list function to get a list of the OpenLabyrinth activities available for the current remote service. The URL for the call is: http://OpenLabyrinth.mvm.ed.ac.uk/remote.asp

- <OpenLabyrinthservice> is the root element
- <remoteIP> is the IP address as seen by OpenLabyrinth
- <OpenLabyrinthmap> is the parent element per activity
- <OpenLabyrinthmapid> is the current activity's map ID (integer)

- <OpenLabyrinthmapname> is the current activity's title
- <OpenLabyrinthmaproot> is the root mnode ID (integer) for the current activity

As an example:

```
<?xml version="1.0"?>
<OpenLabyrinthservice>
	<remoteIP>129.215.133.15</remoteIP><OpenLabyrinthmap>
		<OpenLabyrinthmapid>174</OpenLabyrinthmapid>
		<OpenLabyrinthmapname>ESSQ+1</OpenLabyrinthmapname>
		<OpenLabyrinthmaproot>2054</OpenLabyrinthmaproot>
	</OpenLabyrinthmap>
	<OpenLabyrinthmap>
		<OpenLabyrinthmapid>178</OpenLabyrinthmapid>
		<OpenLabyrinthmapname>ESSQ+Jaundice+1</OpenLabyrinthmapname>
		<OpenLabyrinthmaproot>2129</OpenLabyrinthmaproot>
	</OpenLabyrinthmap>
</OpenLabyrinthservice>
```

7.4.2: Transaction: OpenLabyrinth

This is the main transaction type with OpenLabyrinth which processes the activity as it plays out.

The URL for this is: http://OpenLabyrinth.mvm.ed.ac.uk/mnode.asp?id=x&mode=remote&sessID=y

The value for sessID can be left blank for the root node transaction but is required thereafter to maintain scores etc. As log as the node ID requested is in an activity that is allowed in the current service an XML response is sent back with the following elements:

- <OpenLabyrinth> is the root element
- <mnodetitle> is the current node's URL-encoded title
- <mapname> is the current activity's URL-encoded title
- <mapid> is the current activity's (integer)
- <mnodeid> is the current node's ID (integer)
- <mapscore> is the current activity score (integer)
- <message> is the current node's URL-encoded body text
- <colourbar> is the current node's URL-encoded text indicating the use of colour bars for zoned scores (in game mode only)
- <linker> is the current node's URL-encoded HTML links
- <tracestring> is the current node's URL-encoded HTML for the trace/track
- <rootnode> is the node ID for the current activity's root node (integer)
- <infolink> is the current node's 'info' button URL-encoded HTML
- <usermode> is a toggle value between basic and expert
- <dam> is a list of any associated MVP Data Availability Model nodes
- <mysession> is the GUID for this particular user session
- <counterstring> is URL-encoded text of links for all the counters in this map
- <timestring> and <javascripttime> are deprecated in the current version - disregard

As an example:

```
<?xml version="1.0"?>
<OpenLabyrinth>
	<mnodetitle>Start</mnodetitle>
	<javascripttime></javascripttime>
	<mapname>ESSQ+Jaundice+1</mapname>
	<mapid>178</mapid>
	<mnodeid>2129</mnodeid>
	<mapscore>100</mapscore>
	<timestring></timestring>
	<message>%3Cp%3Eyou+are+a+FY2+in+general+surgery+on+call++you+are+phoned+by+a+GP+who+
	has+a+55yo+woman++in+his+surgery+who+appears+jaundiced++what+do+you+do+now%3A%3C%2Fp%
	3E</message>
	<colourbar>%3Ctable+border%3D%270%27+width%3D%27100%25%27+cellpadding%3D%275%27%3E%3C
	tr%3E%3Ctd+height%</colourbar>
	<linker>%3Cp%3E%3DABBCE08B%2D1F75%2D4A0A%2D852B%2D21F0819A19A2%27%3EID%3D%5B27%5D%5D%
	5D%5D+%2D+arrange+urgent+review++the+patient+comes+to+hospit%3C%2Fa%3E%3C%2Fp%3E</lin
	ker>
	<tracestring>%3Ca+href%3D%22%23%22+onclick%3D%22toggle%5Fvisibility%28%27track%27%29%
	3B%22%3E%3Cp+class%3D%27style2%27%3E%3Cstrong%3EReview+your+pathway%3C%</tracestring>
	<rootnode>2129</rootnode>
	<infolink></infolink>
	<usermode></usermode>
	<dam></dam>
	<mysession>ABBCE08B-1F75-4A0A-852B-21F0819A19A2</mysession>
	<counterstring></counterstring>
</OpenLabyrinth>
```

7.4.4: Transaction: service

This is a combined function that connects to three different OpenLabyrinth services:

- Information: http://OpenLabyrinth.mvm.ed.ac.uk/info.asp?id=x&mode=remote&sessid=y
- Counters: http://OpenLabyrinth.mvm.ed.ac.uk/counter.asp?id=x&cid=y&mode=remote&sessid=z
- DAM Nodes: http://OpenLabyrinth.mvm.ed.ac.uk/counter.asp?id=x&did=y&mode=remote&sessid=z

Each of these scripts bundles their response as a single XML element:

- <OpenLabyrinth> the root element
- <service> a URL-encoded HTML text response

The following info button call is an example:

```
<?xml version="1.0" encoding="UTF-8"?>
<OpenLabyrinth>
	<service>Your+role+in+this+clinic+is+to+review+patients+on+behalf+of+your+Senior%2E+H
	e+is+present+in+the+clinic%2C+and+will+call+in++to+see+if+you+are+progressing+well+in
	+the+case%2E+++This+is+the+Virtual+Hospital+Environment+%28VHE%29%2C+take+advantage+o
	f+the+fact+there+is+no+time+pressure+and+make+sure+you+understand+the+basic+sciences+
	you+are+applying%2E+++Better+than+getting+a+textbook+out+in+front+of+the+patient%2E</
	service>
</OpenLabyrinth>
```

7.5: Basic OpenLabyrinth Client Functions

The OpenLabyrinth client is relatively thin in that it only needs to send out appropriate and well-formed requests and to parse, format and present the returned XML data. As any free-text information is exchanged as hexadecimal data a converter from hex to plain text is required as is some data cleaning, for instance:

- Changing instances of "mnode.asp" to the local client URL.
- Changing instances of "/files/" to http://OpenLabyrinth.mvm.ed.ac.uk/files/ in any OpenLabyrinth resource URLs (such as images).

- Changing certain links so that they open in a new window.
- Changing instances of any HTML escaped characters back to their base format, for instance instances of "'" should be turned back to an apostrophe.

7.6: OpenLabyrinth Client Enhancements

The previous few sections have outlined the underlying basics of creating a remote OpenLabyrinth client service. It is possible however to build additional services on top of this as meet the requirements of the system in which the client service is instantiated. These services may be global to all surfaced OpenLabyrinth cases, they may be attached to specific activities (identified by their unique map ID) or to specific nodes (identified by their unique node ID).

Examples from existing clients include:

- The ability for users to make their own notes either at a particular node or throughout an activity
- The ability for users to record particular kinds/formats of data, for instance when working with a virtual patient it is useful to be able to record several differential diagnoses, to rank them and then to progressively whittle them down to a definite diagnosis as the activity unfolds
- Cross-integration and mashups with other dynamic web applications

8. Customization: Skins and Mashups

8.1: Skins

The skins control how the labyrinth is presented to the user. The skin for a particular labyrinth can be changed in the global editor. Standard installed skins include basic, PDA and NOSM, the latter is presented as a development template for users to develop their own OpenLabyrinth skins.

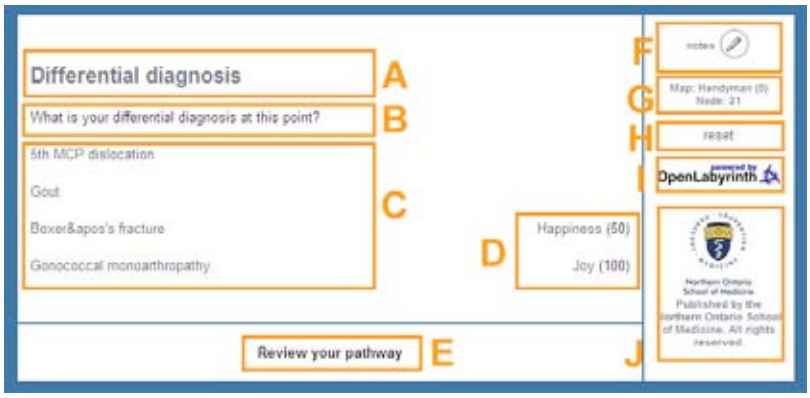


Figure 21: an example OpenLabyrinth skin (for St Georges Medical School, London, UK)

There are a number of different presentation elements in an OpenLabyrinth skin (see figure 21):

A: title B: message C: options

D: counters E: review session F: notes

G: metadata H: reset session I: link to home page

J: skin-specific content

Effectively all that different skins do is to change the layout and visual presentation of these elements – see figure 22

Figure 22: some example OpenLabyrinth skins

To create a new skin:

- Create a new skin folder in the skins folder, you could start by duplicating an existing one
- Edit the ASP skin script and the accompanying CSS stylesheet to change the HTML layout of the skin elements, adding new content as you require
- Add the skin reference to the SKINS table in the database – this will allow it to be presented as an option in the global editor

8.2: Code

OpenLabyrinth has been written in an open and largely modular way to allow for new developments and changes to the code base. Moreover, OpenLabyrinth is provided as open source, which means that users are free to reuse and adapt the code to meet their own needs. You are strongly encouraged, although not required, to share any new code with the OpenLabyrinth community. Examples of code changes could include:

- New services such as tracking a differential diagnosis
- New data elements such as those for a different professional discipline
- Integration with other systems such as VLEs, assessment systems or

The homepage can also be customized, in particular there is a section below the

Figure 23: the OpenLabyrinth homepage

8.3: Documentation

A copy of this user guide is also provided in PDF and Word DOC format. This can be amended and reused as set out in the Creative Commons Attribution-Noncommercial-Share Alike 3.0 license (see http://creativecommons.org/licenses/by-nc-sa/3.0/). For instance you could add new instructions, translate or adapt it for different contexts.

8.4: Mashups

OpenLabyrinth remote web services can be used to create mashups with other remote applications. For instance:

- a labyrinth could be used to link with a wiki by pairing its nodes with the wiki pages
- a labyrinth could be used to link with other mashup applications such as Flickr, YouTube or various Google services

See section 7 for more information on using the OpenLabyrinth remote services.

9. Development Techniques

This section pulls together some advice and tips on creating and using OpenLabyrinth activities.

9.1: Using Vue

Vue is a free topic-mapping tool from Tufts University - see http://vue.uit.tufts.edu/ for both Windows and Mac. You can use it to create designs for labyrinths by creating boxes to represent nodes and the links between them. Although Vue supports many other features only the boxes (converted to nodes) text in the boxes/nodes and the links (between nodes) will be imported but everything else will be ignored.

Vue allows a whole design to be viewed at once, and to be built in whatever way the author(s) wish (see figure 19 for some examples). For instance a Vue design could be data projected for a group of authors to comment and build up a map collaboratively.

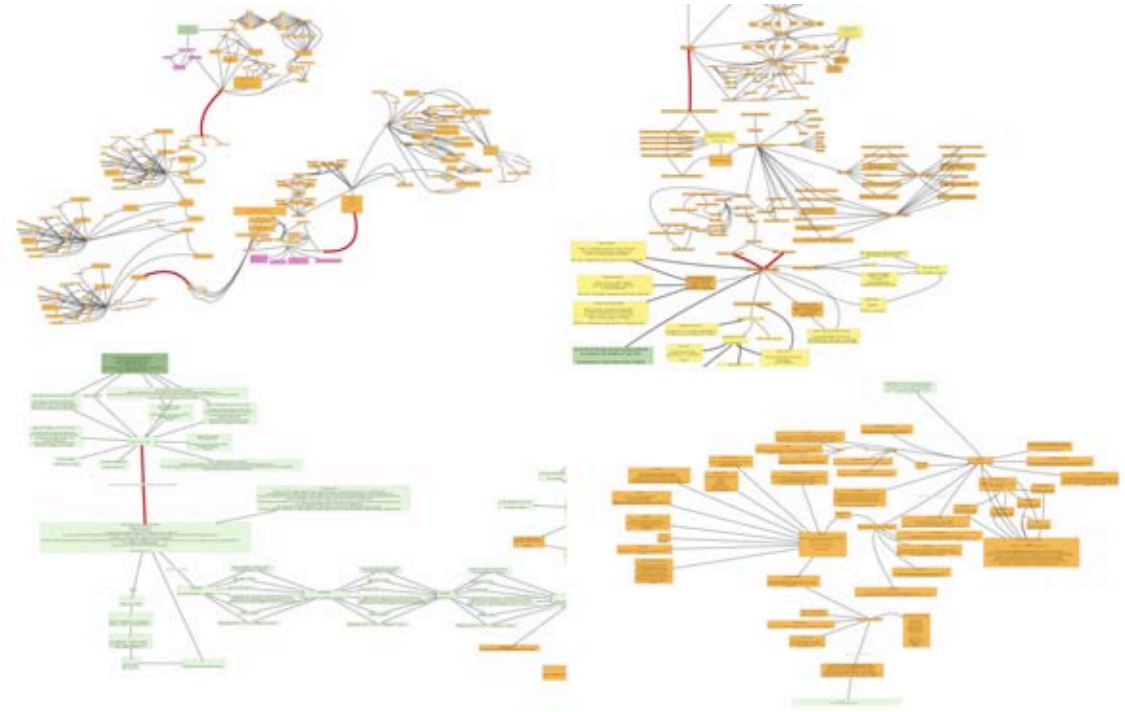


Figure 24: Some example labyrinth designs in preparation in Vue

As well as creating labyrinth designs in a stepwise manner parts of other designs can be copy-pasted into new designs. For instance a design for an interview or making a diagnosis can be reused across a number of designs. Reusing these ‘design patterns’ can make development faster and more effective.

9.2: Using Nodes

A node consists of a container for HTML content plus a number of rules and functions. A node may need to be duplicated if one or the other differs. Furthermore, a node may contain a media object that presents an activity in

its own right, for instance an assessment question, an animation or an interactive object such as a puzzle or a mini game.

9.3: Using Links

The links represent the topology of the labyrinth activity. You can use these links creatively to assemble different kinds of labyrinths:

- A randomly selected link can be used to represent a dice throw – make six links each for one of the dice values and then set the node to select just the one randomly. When the labyrinth is played the dice throws will be randomly selected each time, use alternative link text to hide what the value is.
- You can use alternative text and icons to control how options are presented to the user. For instance, you can allow users to select the image that best suits the question such as interpreting an x-ray or a histology image
- You can use different link types to create more specific designs. For instance, Key Feature Problems (KFPs) can be designed using dropdown menus (Fischer et al 2005).

9.4: Using Counters

You can use counters to track different kinds of values during an activity:

- Costs: a maximum financial budget can be set as the starting value and each choice that involves expenditure can have that cost deducted from the budget.
- Time: a time budget can be deducted from or arbitrary time added to based on the choices made. For instance, selecting a blood pressure test may take 3 minutes while a CT scan may take an hour.
- Psychological factors such as morale, general health or satisfaction can be tracked based on choices made.
- Clinical specific factors such as blood pressure, heart rate or respiratory rate can also be tracked against decisions made.
- Artefacts such as tools, drugs, equipment or keys can be acquired (value increased) and used (value decreased) using counters.

Remember that you can have any number of counters in any one labyrinth.

9.5: Different Kinds of Labyrinth Designs

There are lots of different kinds of designs you can build in Labyrinth:

- Standard professional narratives such as history, examination, investigation, diagnosis and treatment.
- Narratives based on single cases or having to deal with multiple cases at once, each intruding or interrupting the other
- Algorithms such as clinical guidelines, diagnostic pathways for technical or user documentation.

10. Further Information and Resources

OpenLabyrinth is provided as open source code and as such the authors accept that there may be some bugs and problems but make no guarantees and accept no liabilities for the same. If bugs are found then either fix them and share the code back to the OpenLabyrinth community or make a request for a fix to the community.

As for user support there ain't none – 'they' are 'us'. OpenLabyrinth community members will generally help each other work through problems but only inasmuch as they have the ability and time to do so. As with any community it takes all members to work together to make the system stronger and better. Suggestions and ideas for new developments should also be circulated to the community.

OpenLabyrinth is licensed under the Academic Free License (AFL) v. 3.0 – see appendix 2.

References

Begg, M., Dewhurst, D. and MacLeod, H. (2005). "Game Informed Learning: Applying computer game processes to Higher Education." Innovate 1(6).

Begg, M., Ellaway, R., Dewhurst, D. and Macleod, H. (2007). "Transforming Professional Healthcare Narratives into Structured Game-Informed-Learning Activities." Innovate 3(6).

Ellaway, R. (2004). "Modeling Virtual Patients and Virtual Cases." MELD. http://meld.medbiq.org/primers/virtual_patients_cases_ellaway.htm

Ellaway, R. (2007). Discipline Based Designs for Learning: The Example of Professional and Vocational Education. Design for Learning: rethinking pedagogy for the digital age. Beetham, H. and Sharpe, R., Routledge: pp153-165.

Fischer M., Kopp V, Holzer M, Ruderich F, Jünger J (2005) "A modified electronic key feature examination for undergraduate medical students: validation threats and opportunities" Medical Teacher, Volume 27, Issue 5, 2005, Pages 450 – 4

Appendix 1A: Installation

OpenLabyrinth is a web application written using Active Server Page (ASP) code written in VBScript. To run it needs to be running in Internet Information Services (IIS), which is part of Microsoft server platform (as well as Windows XP/Vista for single users). OpenLabyrinth also requires a database joining the code and the database using an ODBC connector. The most suitable database is MS SQL Server (the Express edition is available for free). Note that the setup requires a certain amount of technical experience in using server properties of Windows platform.

Preparation

Provide one or more servers on which you will first need to install:

- MSXML (latest version) - see http://www.microsoft.com/downloads/results.aspx?productID=&freetext=msxml or http://www.microsoft.com/downloads/details.aspx?FamilyID=3144b72b-b4f2-46da-b4b6-c5d7485f2b42
- Internet Information Server (IIS) see http://www.microsoft.com/WindowsServer2003/iis/default.mspx
- Microsoft .NET Framework v2.0 see http://www.microsoft.com/downloads/details.aspx?FamilyID=0856eacb-4362-4b0d-8edd-aab15c5e04f5&displaylang=en
- SQL Express (with Advanced Services) or equivalent ODBC-compliant database see http://www.microsoft.com/sql/editions/express/default.mspx
- XZip see http://xstandard.com/en/downloads/?product=zip

Code and Directory

- Download the OpenLabyrinth package from http://sourceforge.net/projects/openlabyrinth/ and unzip its contents.
- Copy the contents of the 'code' directory from the unzipped OpenLabyrinth package to a new directory in the 'wwwroot' (or equivalent) directory. Depending on the setup of your IIS instance this will either be a subdirectory of the default website or will need to be set up as a new website:
    - If OpenLabyrinth is part of the default website (or other existing website) then open IIS, right click the default (or other) website, select the 'documents' tab and add 'index.asp' as a default document if it isn't currently in the list.
    - If OpenLabyrinth is going to be a new website then follow the usual steps – see http://technet2.microsoft.com/windowsserver/en/technologies/featured/iis/default.mspx

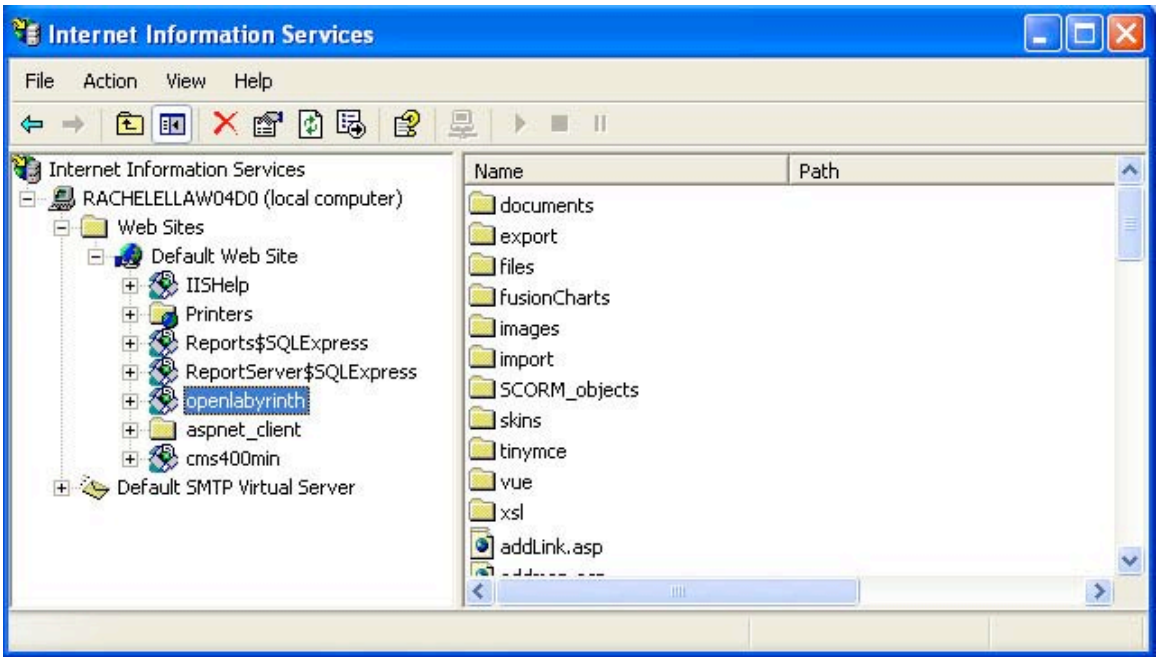


Figure A1: an IIS instance of OpenLabyrinth showing it running in the default website

- edit 'settings.asp' file and set the variables OLPath and BasePath to match your local build paths
- set folder permissions for ‘export’, ‘files’, ‘import’ and ‘vue’ for the IUSR using extended permissions and select all except for full control, traverse folder, change permissions and take ownership

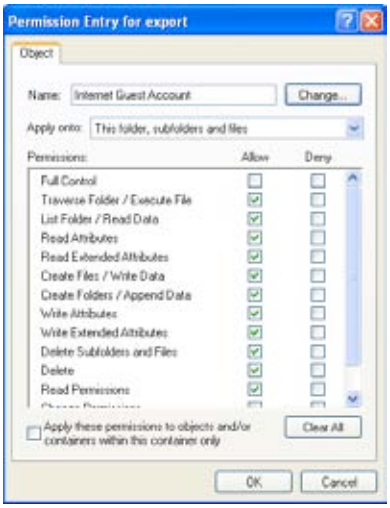


Figure A2: setting the directory permissions

You have now put the code part of OpenLabyrinth in place. The next step is to set up the database.

Database Setup

You installed SQL Server 2005 Express or ensured you had an ODBC SQL database available as part of the preparation step. Note that there are many factors that may change the nature of the following tasks – you should consult a database administrator for help if you get stuck.

Once the database is available:

- Add a new database called 'OpenLabyrinth'.
- Run the script ‘ol25master.sql’ to create the tables and views.
- Open the ODBC Control Panel (Control Panels, Administrative Tools) and add ‘OpenLabyrinth’ as a System Data Source Name (DSN).
- Add the local IUSR account to the database as a user.
- Set permissions for IUSR for all stored procedures, views and tables – this will vary depending on the database setup you use but should allow permissions for CONNECT, DELETE, EXECUTE, SELECT, UPDATE
- Manually add yourself as a superuser directly to the USERS table making sure SuperUser='y' and userType='s'
- Launch a web browser and browse to the OpenLabyrinth site – typically if you are running on a local computer and have placed the OpenLabyrinth directory in the website root then the URL will be http://localhost/openlabyrinth/.
- Log in using the account you manually added to the USERS table.

Once you have completed these steps that should be OpenLabyrinth all ready to go!

Appendix 1B: Upgrade

If you are using a previous version of OpenLabyrinth and want to upgrade then you should be clear that a number of essential changes have been made since the last version

CAUTION: take a full backup of the code, content and database before proceeding.

Add new tables from the ol25master.sql script: QUESTION, QUESTION_RESPONSE, COLLECTION, COLLECTION_MAP, COLLECTION_USERS, PUBLISH, CONTRIBUTOR. Depending on the version you are using then check other tables are matched between your current build and the ol25master.sql script.

The following outlines the changes to existing tables:

Table	*Column*	*Action*
VPD	VPDID	int identity pk
	MapID	int
	VPDType	vc50
	OldVPDID	vc50
VPDELEMENT	VPDElementID	int identity pk
	VPDID	int
	MapID	int
	ElementType	vc50
	ElementValue	vc 2000
	OldVPDElementID	vc50
DAM	DAMName	varchar(500)
	DAMID	int identity pk
	MapID	int
	DAMName	vc100
	OldDAMID	vc50
DAMELEMENT	DAMElementID	int identity pk
	DAMID	int
	DAMElementType	vc20
	DAMElementOrder	int
	DAMElementDisplay	vc15
	DAMElementRef	int
	To update DAM references from OldMRElementID to MRElementID – use ‘updateDAMv210.asp’ - run once then delete	
USERSESSIONTRACE	MapScore	Delete column
	MapScoreNow	Delete column
	Add column MDAMs	varchar(200)
MRELEMENT – follow these	remove PK	

instructions in order	rename MRID to MapID	int
	rename MRElementID to OldMRElementID	
	new column MRElementID	int PK identity
change AVATAR	add column OldAvatarID	int
	make all char(1) columns into varchar(2)	
Stored Procedure: TRACE_SESSION	remove dbo.USERSESSIONTRACE.MScore and dbo.USERSESSIONTRACE.MScoreNow from	

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